

Chem2110 Quiz 1

October 2010

TIME: 1¼ Hours

NAME: MODEL ANSWERS

ID NUMBER: _____

1 H 1.008																	2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226	89 Ac[†] (227)															

Question	Maximum Marks	Score
1	47	
2	38	
Total	85	

QUESTION 1

(a) Write the **name** of each of the following compounds: **(10 marks)**

PdCrO_4	palladium(II) chromate
$\text{NH}_4\text{Fe}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	ammonium iron(III) sulfate dodecahydrate
$\text{Mg}(\text{IO})_2$	magnesium hypoiodite
RbO_2	rubidium superoxide
$\text{NiF}_2 \cdot 4\text{H}_2\text{O}$	nickel(II) fluoride tetrahydrate
$\text{HBrO}_3(aq)$	bromic acid
KMnO_4	potassium permanganate
Tl_3As	thallium(I) arsenide
$\text{H}_2\text{CO}_3 \quad (aq)$	carbonic acid
Cl_2O_7	dichlorine heptoxide

(b) Write a formula for each of the following substances: **(10 marks)**

Dinitrogen tetroxide	N_2O_4
Antimony(III) acetate	$(\text{CH}_3\text{COO})_3\text{Sb}$
Aluminium hydrogen phosphate	$\text{Al}_2(\text{HPO}_4)_3$
Mercury(I) bromite	$\text{Hg}_2(\text{BrO}_2)_2$
Strontium sulfide	SrS
Hydrocyanic acid	$\text{HCN}(aq)$
Hydrogen selenide	H_2Se
Zinc bicarbonate	$\text{Zn}(\text{HCO}_3)_2$
Gold(III) nitrite hydrate	$\text{Au}(\text{NO}_2)_3 \cdot x\text{H}_2\text{O}$
Cesium dichromate	$\text{Cs}_2\text{Cr}_2\text{O}_7$

(c) Complete the following statements: (27 marks)

- (i) H^+ is an electrophile whereas H^- is **a nucleophile** and H is **a free radical**
- (ii) P^{3-} is a **monatomic anion** whereas PO_4^{3-} is **a polyatomic anion**
- (iii) Sr is a **metal** whereas Se is a **metalloid** or **semimetal** (your textbook says **nonmetal**)
- (iv) The name of the **alkaline earth** metal ion found in bones and teeth is **calcium ion**
- (v) The elements in the Periodic Table are arranged in order of increasing number of **protons**
- (vi) The mathematical equation that states the Heisenberg uncertainty principle is **$\Delta x \cdot \Delta(mv) \geq h/(4\pi)$**
- (vii) Wave functions of atomic orbitals are obtained from the **Schrödinger** equation.
- (viii) Isotopes are **atoms of a given element that have different mass numbers (or different numbers of neutrons)**
- (ix) Whereas nitrogen is a major element in the human body, copper is a **trace** element.
- (x) The name of H^+ is **proton**
- (xi) Ammonia is **molecular (or covalent)** whereas K_2SO_4 is **ionic**
- (xii) CO_2 is a compound whereas S_8 is **an element**
- (xiii) The elements in Group 1 are collectively known as **alkali metals**
- (xiv) In **covalent** bonding, two atoms share **electrons**
- (xv) Chemical bonds can be classified as ionic, **pure (nonpolar) covalent** and **polar covalent**
according to **the electronegativity difference between the atoms chemically bonded together**

(xvi) Sr is an *s*-block element whereas Sn is **a *p*-block element** and Sc is **a *d*-block element**.

QUESTION 2

(a) Complete the following table: **(8 marks)**

Symbol	Number of protons	Number of electrons	Number of neutrons	Net charge	Name of substance
Bi^{3+}	83	80		+3	bismuth(III) ion
$^{130}\text{Te}^{2-}$	52	54	78	-2	telluride ion
^2H	1	1	1	0	deuterium
Cd^{2+}	48	46		+2	cadmium ion

(b) For each of the following substances, give the number of **unpaired electrons** in the ***d*-orbitals**: **(4 marks)**

Vanadium(V) ion **0** Chromium atom **5**

Copper atom **0** Iron(III) ion **5**

(c) Which atomic orbitals in an atom have the following quantum numbers? **(4 marks)**

$n = 3, \ell = 0, m_\ell = 0$ **3s** $n = 4, \ell = 2$ **4d**

$n = 2, \ell = 2$ **none** $\ell = 3$ **f**

(d) What is the maximum number of electrons in an atom that can have the following quantum numbers? **(2 marks)**

$$n = 3, m_l = 0, m_s = +\frac{1}{2} \quad \mathbf{3} \qquad n = 3, \ell = 1, m_s = +\frac{1}{2} \quad \mathbf{3}$$

(e) Complete the following table. **(20 marks)**

	Lewis structure(s)	Orbital shape (drawing and name)	Molecular shape (drawing and name)
H₂CO			
XeO₂F₂			
Sulfite ion			

BrF₄⁻			
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